CLAIMS

We Claim:

1 A method for obtaining an optimal reflectivity value for complex multilayer stacks, comprising:

(a) generating a model of a multilayer stack and parameterizing each layer by a thickness and an index of refraction;

(b) allowing a user to input values for the parameters;

(c) calculating an extrema for a cost function of reflectivity R using the input parameter values;

(d) calculating sensitivity values S for the extrema points; and

(e) obtaining an optimal value by calculating a cost function $R + S$.

2 The method of claim 1 wherein step (e) further includes the step of: calculating the cost function as $R + \alpha \cdot S$, where α is a weighted parameter.

3 The method of claim 1 wherein step (a) further includes the step of: providing the multilayer stack with N layers, where a top layer comprises a top ambient resist layer followed by one or more layers of materials that are patterned over a substrate layer.

4 The method of claim 2 wherein step (a) further includes the step of: providing the index of refraction to include a real and an imaginary number.

5 The method of claim 4 wherein step (a) further includes the step of: providing a j^{th} layer with thickness d_j, and a complex index of refraction $n_j = n_j - i\,k_j$.

6 The method of claim 5 wherein step (a) further includes the step of: providing the ambient and substrate with complex indexes of refraction: $\mathbf{n}_0 = n_0 - i\,k_0$ and $\mathbf{n}_{N+1} = n_{N+1} - i\,k_{N+1}$, respectively.

7 The method of claim 6 wherein step (a) further includes the step of: defining reflectivity at an interface between two layers as a cost function, wherein the reflectivity R_j at a j^{th} interface (between the $(j-1)^{th}$ and j^{th} layers) is a function of $3(N - j + 1) + 4$ parameters, which are ; $n_{j-1}, n_j \ldots n_N, n_{N+1}; k_{j-1}, k_j \ldots k_N, k_{N+1}; d_j, d_{j+1} \ldots d_N$.

8 The method of claim 1 wherein step (b) further includes the step of: allowing the user to enter values for the thickness and the complex indexes of refraction (n and k) for each layer, including a current starting point, a minimum values, and a maximum value.

9 The method of claim 8 wherein step (b) further includes the step of: allowing the user to choose which of the parameters will be independent variables and to enter step values, wherein those parameters that are not designated as varying are fixed.

10 The method of claim 1 wherein step (e) further includes the step of: defining the sensitivity as S = (Max R – Min R) for all varied parameters.

11 A computer-readable medium containing program instructions for obtaining an optimal reflectivity value for complex multilayer stacks, the instructions for:

(a) generating a model of a multilayer stack and parameterizing each layer by a thickness and an index of refraction;

(b) allowing a user to input values for the parameters;

(c) calculating an extrema for a cost function of reflectivity R using the input parameter values;

(d) calculating sensitivity values S for the extrema points; and

(e) obtaining an optimal value by calculating a cost function $R + S$.

12 The computer-readable medium of claim 11 wherein instruction (e) further includes the instruction of: calculating the cost function as $R + \alpha \cdot S$, where α is a weighted parameter.

13 The computer-readable medium of claim 11 wherein instruction (a) further includes the instruction of: providing the multilayer stack with N layers, where a top layer comprises a top ambient resist layer followed by one or more layers of materials that are patterned over a substrate layer.

14 The computer-readable medium of claim 13 wherein instruction (a) further includes the instruction of: providing the index of refraction to include a real and an imaginary number.

15 The computer-readable medium of claim 14 wherein instruction (a) further includes the instruction of: providing a j^{th} layer with thickness d_j, and a complex index of refraction $\mathbf{n}_j = n_j - i\,k_j$.

16 The computer-readable medium of claim 15 wherein instruction (a) further includes the instruction of: providing the ambient and substrate with complex indexes of refraction: $\mathbf{n}_0 = n_0 - i\,k_0$ and $\mathbf{n}_{N+1} = n_{N+1} - i\,k_{N+1}$, respectively.

17 The computer-readable medium of claim 16 wherein instruction (a) further includes the instruction of: defining reflectivity at an interface between two layers as a cost function, wherein the reflectivity R_j at a j^{th} interface (between the $(j-1)^{th}$ and j^{th} layers) is a function of $3(N - j + 1) + 4$ parameters, which are ; n_{j-1}, n_j ... n_N, n_{N+1}; k_{j-1}, k_j ... k_N, k_{N+1}; d_j, d_{j+1} ... d_N.

18 The computer-readable medium of claim 11 wherein instruction (b) further includes the instruction of: allowing the user to enter values for the thickness and the complex indexes of refraction (n and k) for each layer, including a current starting point, a minimum values, and a maximum value.

19 The computer-readable medium of claim 18 wherein instruction (b) further includes the instruction of: allowing the user to choose which of the parameters will be independent variables and to enter instruction values, wherein those parameters that are not designated as varying are fixed.

20 The computer-readable medium of claim 11 wherein instruction (e) further includes the instruction of: defining the sensitivity as S = (Max R – Min R) for all varied parameters.